PUBLIC WORKS

CITY COUNTY STATE

CONCRETING CONNECTICUT STATE ROAD REPLACING OLD MACADAM SURFACE

Naugatuck Valley route. Half section of road on right finished and carrying traffic. Other half being concreted.

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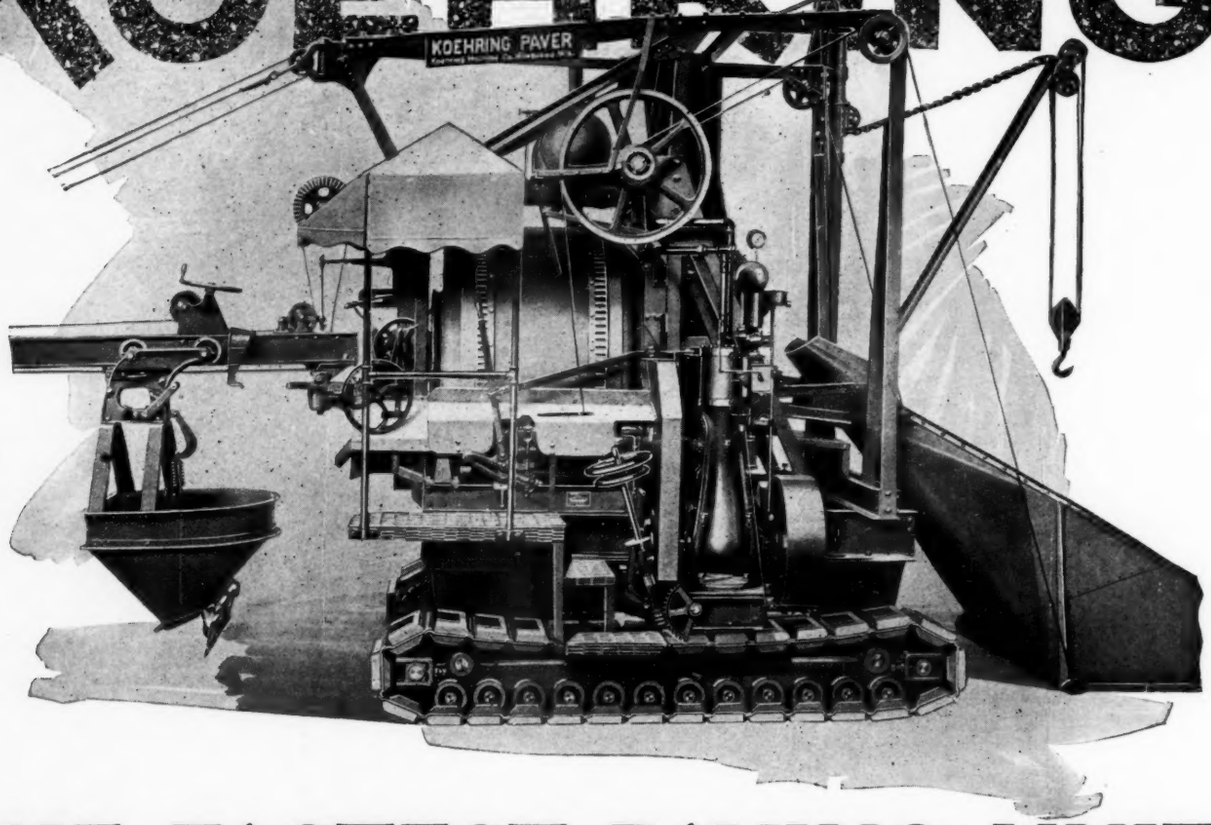
AUGUST 6, 1921

KOEHRING



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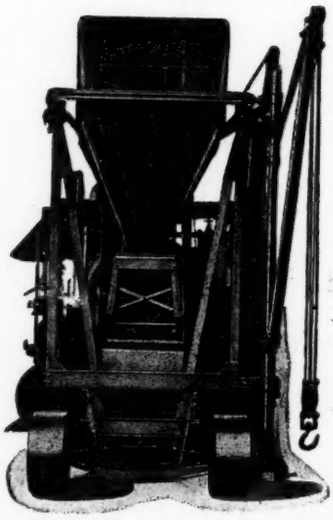

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CITY COUNTY STATE

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The State Highway System of Connecticut

Development and cost of state roads. Receipts from motor vehicles, amounts assessed on commercial motor vehicles. Rational control of truck traffic beneficial. Enforcement of traffic regulations. Classification of highways and revenue anticipated.

The most important development in the highway situation in Connecticut during the past six months has been the final establishment of the relations between the construction, reconstruction and maintenance costs of the state system and the financing for the same.

The situation a few years ago was one in which traffic considerations were almost independent of road engineering since the stone and gravel roads then constructed represented the highest class of roads and were more than ample for all of the then present or then anticipated traffic. With the advent of high-speed and high-powered motor vehicles, this has been entirely changed, and it has become apparent that substantially a new system of greatly increased road capacity of different construction types is required very largely in behalf of automobiles. These, therefore, constitute a favored class which should in equity bear a proportionate share of the burden entailed.

PROPORTIONING COSTS

By the use of official data, it has been possible to classify the cost of future construction and to a considerable extent, the proportion of deterioration due to the different classes of service; and from a study of these and other data of the State Highway Department, it became apparent that an enormously greater amount of funds was required immediately and continuously, and it appeared equitable to assess this to a very considerable portion of the automobile traffic. Considering the respective amounts and the importance of the pleasure and commercial traffic, the Highway Department assumed that an apportionment of two-thirds of the special automobile revenue might justly be derived from the pleasure cars and the remainder from the commercial cars.

Up to 1915 most of the motor vehicle fees received by the Highway Department were derived from pleasure vehicles and only a very small percentage came from motor trucks; but since that time the percentage of motor trucks registered has quadrupled, there has been a large outlay necessary for widening, strengthening and otherwise improving hard-surface roads, and concrete reconstruction of the principal lines of highways has cost from $40,000 to $60,000 per mile as compared with a maximum of $6,000 or $7,000 per mile for the macadam, stone and gravel roads that sufficed before the automobiles arrived.

This, of course, multiplied many times the expenditure of the Highway Department, which has increased to $6,000,000 or $7,000,000 annually, exclusive of the town, county and federal aid expenditures. This large sum can be raised by either a direct tax levy on all the people of the state, by bonding the cost of new construction, or preferably by allotting to the more direct beneficiaries of improved highways a just share of the cost of securing them, as was strongly urged after a careful review of the past, present and future conditions to be met by the state and its officers.

With this proposition, the Highway Department brought up the subject for legislative action, and, of course, encountered the expected violent opposition, but the arguments, reinforced by unimpeachable data, were so strong that the different committees were soon convinced and the question became one of amount and details of operation. The theoretical assessment, as computed from a consideration of the investment, the operation, the relative advantages to and the benefits derived by the five-ton motor trucks, indicated

that a logical proportion might be derived by assessing them the unprecedented amount of $750 each per annum, but as this was manifestly impracticable, the request was reduced to a modest $450, and after a very thorough discussion and strong efforts, considerable practical success was achieved by accomplishing an actual imposition of $187.50 for a five-ton truck annually. The schedule of fees up to that point is in proportion. Beyond that point, the truck is practically prohibited.

The old fees, together with those provided by general taxation and other sources, have given during the current year a total of $6,000,000 which will be expended in the proportion of about $2,000,000 for maintenance, temporary work and repairs; $2,000,000 for reconstruction; and $2,000,000 for construction, including $700,000 for bridge work.

CONTROLLING ROADS AND TRAFFIC

Although the truck owners at first very naturally felt grieved at the increased tax, their attitude has been greatly modified and is due in considerable measure to the somewhat unusual and very successful system developed by the department during the last winter and spring when the roads were affected by snow and frost and rain, so that the heavy trucking service on them became not only more difficult, but in many cases threatened great injury to the roads. Recognizing this, the department legally closed certain roads, or portions of roads, routed the traffic through other parts of the system, and attempted to enforce a very careful restriction on loads.

This resulted not only in the saving of a great many thousands of dollars in possible damage which might have accrued through the injudicious use of the roads, but at the same time resulted in the maintenance of open traffic routes throughout the worst of the season and cared for all of the necessary business that had to be transacted. The truck owners did not fail to realize this, and as a whole have become appreciative and friendly to the system and its enforcement.

LIMITING LOADS

There is a regulation in the state restricting the load, including the weight of the truck, to 25,000 pounds, and the highway commissioner has the right, if he sees fit, to recommend the licensing of trucks in excess of that amount on certain specified routes. He may also, in his discretion, at certain seasons of the year, or on certain highways, restrict the loads.

Under the new law, which is a modification of the old one, he also is allowed to call upon the Motor Vehicle Commissioner, in connection with matters for the enforcement of these regulations at particular points, and the Motor Vehicle Department is working in co-operation, of course, with the Highway Department and attempting to enforce the laws. This co-ordination is achieving and promising exceptionally good results.

The Motor Vehicle Department has established at the state line in two places stations at which are located inspectors who are attending to the regulation of traffic and the restriction of loads. This has been quite a material help in cutting down the over-loading.

CLASSIFICATION AND MILEAGE

The state of Connecticut has 1,600 miles of state highways. In addition to this, there are about 10,400 miles of unimproved highways and probably 75 miles of concrete, a little of which is only 16 feet wide; practically all of it is 18 feet or more in width. There are about 100 miles of bituminous concrete which is either on a concrete base or on a stone base. There are about 50 miles of bituminous macadam and about 400 miles of macadam stone road which is treated superficially with bituminous material, and the remainder is either gravel or combinations of stone and gravel or stone and earth. Practically all are treated with oil, tar and calcium chloride.

Not more than half of new roads constructed will be concrete; possibly 35 per cent will be concrete or on a concrete base. The remainder will be selected from the other types according to local conditions and requirements.

It is assumed that there will be a falling off of the revenue derived from automobiles for the next few years. The increase has been 20 per cent for three or four years, and it may come down to 15 or 10 per cent. It has probably reached the steepest portion of its increase and will flatten out.

It is expected that the yearly revenue will be $3,000,000 from automobiles and $3,000,000 from other sources, and it is surmised that this amount will probably be the average expenditure of this department for the next few years.

Protecting Foundation Concrete from Running Water in Very Cold Weather

One of the piers of the United States Government Railway bridge over the Susitna river, Alaska, was built in an open pit, sheeted with Wakefield sheet piling and excavated by an orange peel bucket and by pick and shovel.

The excavation was in porous gravel and boulder foundation, through which considerable water penetrated under 25 feet head in the bottom of the pit, and it was considered impractical to deposit the concrete under water by tremie or bottom-dump buckets. The leakage in the cofferdam was eventually controlled by covering the bottom of the 33 x 69-foot excavation by a single large sheet of canvas that extended 6 feet vertically up on the walls of the cofferdam and was formed-in along the sides and ends, providing an exterior flume for the water, which was thus conveyed to the sump, from which it was removed by drainage pumps.

The cofferdam was roofed and steam coils around the edges were provided for heating the interior. Aggregate was dumped on platforms heated by perforated pipe coils and the concrete was mixed with hot water. The concrete was placed in temperatures as low as 12 degrees below zero, was conveyed from the mixer to the pier in pipes and chutes and was not allowed to come in contact with cold water until after it had set. The work was executed under the general supervision of Col. F. Mears, chairman and chief engineer of the Alaskan Engineering Commission.

State Highway Snow Removal in Connecticut

State roads cleared after every snowfall by department maintenance forces with plows and scrapers operated by motor trucks.

An act of the Connecticut legislature, passed in 1917, authorizing the highway commissioner to remove snow from trunk line highways, provides that:

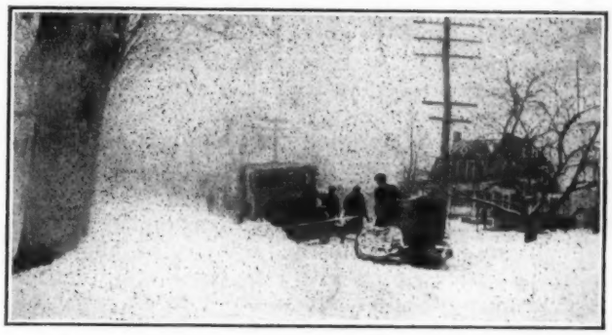
Section 1. The highway commissioner shall cause the removal of snow from any completed portion of any trunk line highway when the accumulation thereof shall render such highway unsafe or impassable for public travel. He may direct the selectmen of any town or officer having charge of such highways in any municipality to remove such accumulation of snow at the expense of the state.

Section 2. Nothing in this act shall relieve the responsibility of street railway companies for the proper removal of snow from their track areas and without the obstruction of the traveled path of the trunk line highways."

The roads are kept clear with snow plows in front of trucks. In the deep drifts, after the truck has broken through, it has to be cleaned out. The Good Roads Machine Company's plows are used. The plow goes down one side of the road and back on the other side, clearing the road for the full width. Under ordinary circumstances one truck and plow will clear a 4-inch (average) snow fall, and will handle ten miles per day easily. The trunk lines are kept open, and state aid roads are not touched until trunk lines are open. About 3 inches of snow is left on the road, which permits runners to go until the first thaw.

NEW MILFORD-LITCHFIELD ROAD

WASHINGTON-LITCHFIELD ROAD



TRUCK AND TRACTOR OPERATING PLOW IN SILVER LANE ROAD

A soft, fresh snow fall up to 3 feet in depth can be penetrated by a 3-ton truck hauling a scraper. If deeper drifts are encountered, it is necessary to shovel or assist by a small tractor in advance that breaks a path for the truck, enabling the truck to remove the heavy snow in short successive operations. Only under serious conditions are tractors used.

The character of the truck work without motor or shoveling assistance is shown in the picture of Litchfield road, New Milford. A road that has been trimmed by shovel after scraping is shown at the Washington-Litchfield line.

When the snow is very compact or frozen, it is sometimes impossible to operate tractor, truck or scraper. In such cases it is plowed like clay. Ordinarily, inside of twenty-four hours roads are made passable. The gangs start out to work when the snow begins to fall.

In order to hold the truck down so that it will drive in the snow removal it is always necessary to load it heavily.

The High Cost of Poor City Pavements

By Clarence D. Pollock

A great deal has been said about the deplorable condition of our railroads and much attention has been given to the highways of the country, but city pavements have been left out of consideration to a large extent.

They had to be neglected during the period of the war. Very few, however, seem to have considered them since then, although they are a very great factor in the collection and distribution of freight. The condition of the city pavements is very important in the economical handling of construction materials and food products.

Pavements in bad condition add enormously to the cost of upkeep of vehicles, in addition to the slowing up of traffic. The city pavements may be compared to a terminal railroad, as they provide the means of distributing the freight from the trunk railroads as well as that hauled by trucks over the highways.

Anything that causes a slowing up of the street

traffic causes greatly increased freight charges. The poor pavements cause less mileage per truck per day and in addition necessitate the consuming of a much greater quantity of gasoline. With the high price and scarcity of gasoline, this latter is by no means a negligible item. The gasoline item is not the largest item by any means, still it is a considerable one.

Another item is the wear and tear on the trucks and automobiles. With the high cost of labor and materials which enter into auto truck repairs, this is a large figure in connection with the cost of handling construction materials, and, in fact, all kinds of materials and supplies.

While it may be expensive to lay city pavements at the present time, it is more expensive to neglect them and pay the extra cost of handling freight and food supplies. This is a point that seems to be overlooked by the average taxpayer and city resident. A little more in taxes to provide good city pavements would, without doubt, be returned several times over in cheaper cost of supplies.

A great deal has been done by material handling concerns in the actual loading and unloading of materials and supplies by means of machinery, but this is largely nullified by the obstacles encountered in the city streets because of poor pavements. When a vehicle is stalled in a rut it not only delays that individual truck, but it obstructs part of the roadway and thus slows up the movement of all other vehicles in passing this point. This is a cost difficult to determine in dollars, but all truck owners know that it is a big item.

The taxpayers should realize this and try to impress the importance of good pavements, kept in good repair, upon their city officials. During the past year many cities started out with elaborate plans to replace their worn-out pavements which they were unable to keep in repair during the war period, but when bids were received, the prices caused them to reconsider and their programs were greatly curtailed. These cities continued to make temporary repairs to their worn-out pavements at great cost, but seem to have forgotten to consider the great cost to the vehicle owners and do not realize that this cost is in turn shifted to the citizens in increased costs of food, building materials, clothing, etc. These poor pavements have made a big increase in the cost of living, which could have been saved to a large degree.

With the lower price of labor and the more reasonable prices of materials this season, the ambitious programs of a year ago should be started now to cut down this heavy haulage cost on supplies.

When the pavements of a city or town are in bad repair it soon becomes known and trucking and pleasure traffic will pass around that locality whenever possible. This causes a loss to the business houses and hotels of that place. These losses are impossible to figure, but they are real losses to such towns and should be thought of when considering the matter of replacing bad pavements.

All these matters should be given proper weight when considering the question of issuing bonds. In many cases it will pay a municipality to pay a higher rate of interest and do the work now rather than wait for a lower interest rate.

In general it does not require the engineer to show the highway traveler where the state roads end and the city or town pavements begin. The city pavements should be kept in as good surface as the state highways—this would not only add to the pleasure and comfort of the highway traveler, but would prove a good business proposition to the municipality.

Refuse Collection in Syracuse

The department of public works of the city of Syracuse has instituted a new plan for the collection of refuse and ashes in the downtown districts, which has been the subject of favorable comment. Under the old scheme the wagons and trailers collected throughout the week, and the result was ashes and refuse on some curb every day. Commissioner George C. Scheerer, when appointed, devised the plan of mobilizing his entire force of men, wagons, trucks and trailers in the downtown section on one morning of each week, thus eliminating collections throughout the week. The plan has been successful, the entire job is finished in two hours, and the department starts work on the residence districts. The business section is clean, and outside of some inconvenience to janitors, which was quickly adjusted, everyone has approved the plan heartily.

Repairing Northern Ave. Bridge, Boston

Bottom chord eye bars removed and new ones added without the use of falsework.

Northern Avenue highway bridge, Boston, has a through pin-connected truss span about 143 feet long and 60 feet wide, carrying three roadways and two cantilever sidewalks. The trusses, 26 feet 3 inches high and 22 feet apart on centers, have 21-foot 2¾-inch panels with bottom chords made of 6 and 7-inch eye-bars having pins from 4½ to 7½ inches in diameter. The floor panels are X-braced with diagonal angles.

The bridge was seriously injured by collision with a scow that broke from its moorings and drifted under it during a heavy storm. The bottoms of many of the vertical posts were badly bent, several of the bottom chord bars were more or less distorted as well as some of the lateral braces and the chord struts. Most of the damage was sustained by the northerly truss where the end struts were bent up 4 inches and the chord bars were bent in three panels. The jaws of the vertical posts engaging the bottom chord pins were badly bent. In the next truss the bottom chord bars in one panel were bent ¾ inch and 2¼inch, four of the lateral struts and their gusset plates were badly bent, and the

fascia girders in three panels were somewhat injured.

The bridge remained in restricted service and the injuries were repaired without building falsework or providing any other support for the bridge, although the operation involved the removal of some of the eye bars in the bottom chords and the reinforcement of those members with new bars, which was accomplished without removing the pins that connected them to the vertical and diagonal members and maintained the integrity of the trusses. In one panel two new 7 x 1 5/8-inch eyebars were added and in another span a single 6 x 1 3/16-inch bar was added, while in several panels the bottom chords were reinforced by the addition of screw ended square rods that were coupled together forming links connecting the lower chord pins.

The lower chord pins fortunately had space between the jaws of the vertical posts to receive the links without interfering with the other members connected there. Outside of the jaws of the vertical posts the original eye bars were packed so closely that they occupied the full length of the pin up to the shoulders, where the ends were turned down to receive the nut, and in this case special new nuts were provided which virtually lengthened the pin enough to receive the new bars 1 5/8 inches thick.

Each link was made with a pair of 1 3/4-inch square U-bars about 3 feet long with upset screw ends passing through a 6 x 3-inch horizontal yoke bar 14 inches long that was bored in the center to receive the screw ends of a straight bar that connected with the yoke engaging the pin at the opposite end of the panel. With this arrangement it was easy to engage each pin separately with its U-bar, assemble the yokes on the ends of the U-bars and finally connect them with the straight bar and make the adjustment by setting up any or all of the nuts at both ends of all the bars.

The new nuts for the 7 5/8-inch pins where eyebars had to be added to the ends were made with L-shape cross-section formed by turning down the inner face of the nut and providing on it a shoulder with the diameter exactly the same as that of the finished pin and a length equal to the thickness of the new eyebar. The new eyebar was carefully assembled in position and supported while the nut was inserted in it and screwed on the pin, thus affording solid bearing for the bar nearly to the extremity of the pin.

In order to get some initial stress in the new eyebars, the distance center to center of the chord pins was measured several times very accurately. The bars were ordered approximately 3/32 of an inch shorter than the average of these measurements.

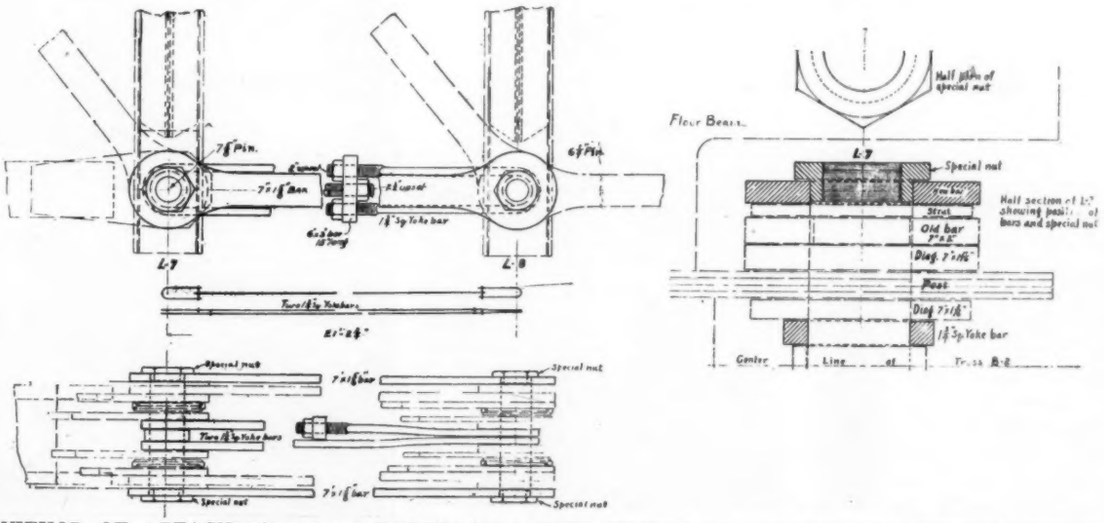
When it came to the erection of these bars it was found that a very little warming enabled the workmen to force them onto the pins and when cool the result was quite satisfactory.

The work was done by the Bridge & Ferry Division of the Public Works Department of the city of Boston, Randall D. Gardner, assistant engineer. It required a force of about ten men for twenty days and cost, including material, $3,745. The bridge was kept in service during the operation and the ingenious method devised avoided the expense, delay and obstruction that would otherwise have been necessary for supporting the bridge on falsework for disconnecting and rebuilding the trusses.

The Detroit-Windsor Bridge

According to the progress report just published in "Canadian Engineer," the designs for this great suspension bridge have progressed far enough to show that it will require for its construction about 107,000 tons of steel, including 50,000 miles of cable wire of high ultimate strength, 8,000,000 rivets and 20,000 tons of cement.

The towers will be 350 feet high and the bridge will carry 40 miles of track rails. The weight and capacity will be several times as great as those of the three great suspension bridges across the East river, New York. Charles Evan Fowler, New York, is the consulting engineer and chairman of the board of engineers.



METHOD OF ATTACHING NEW MEMBERS TO LOWER CHORDS OF INJURED CITY STREET BRIDGE IN SERVICE

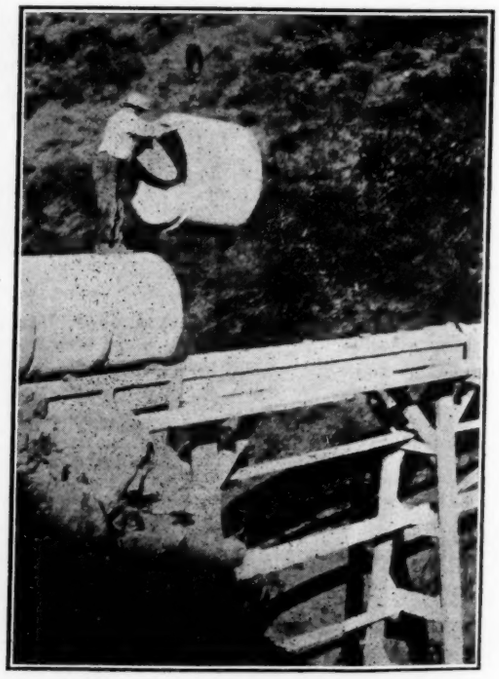
A Reinforced Concrete Pipe and Trestle

The construction of a pipe line and its support entirely of reinforced concrete has recently been accomplished by Bent Bros., Los Angeles, contractors, thus enabling the concreting to be done advantageously at a central plant and permitting the structure to be assembled and erected like a steel or wooden structure, thus classifying the work, facilitating the handling of materials and finished members, and eliminating the necessity of carrying wet concrete, moving the mixing plant or building forms in place where their construction and removal would have been much more difficult and expensive than in the work yard.

The 42-inch pipe was of reinforced concrete with hub and spigot joints made in the thickness of the pipe. Where the pipe line crossed a ravine, instead of carrying it down and up again and forming an inverted siphon that would require to be provided with blow-offs, would be subjected to a considerable increase of pressure above that in the adjacent sections, and might be subject to the accumulation of sediment deposited at the low point, the pipe was carried across at grade on the bents of a reinforced concrete trestle, corresponding substantially to a framed timber trestle.

The bents of this trestle were pre-cast in single stories, each consisting of two comparatively wide, thin, batter posts and top and bottom horizontal cross pieces, making a slightly trapezoidal frame with integral solid web knee braces at each corner. These sections or stories were provided with bearing surfaces at the extremities of the batter posts and clearances between them and were easily assembled and the joints made in the field in very much the same way as wood or timber would have been handled, and providing for rapid construction that, as soon as completed, was ready to carry the large pipe; and the latter, soon after jointing and testing was ready for service, thus considerably reducing the time otherwise necessary for the concrete, cast in forms at the site, to harden and acquire sufficient strength.

ERECTING TRESTLE BENT, STORY BY STORY



ASSEMBLING PRECAST PIPE SECTIONS ON REINFORCED CONCRETE TRESTLE

St. Paul's Municipal Power Plant

The city of St. Paul has applied to the Federal Water Power Commission for a permit to erect and operate a power plant at High Dam on the Mississippi river. It is estimated that the plant would cost $700,000 and develop 10,000 horsepower. The money would be raised by a bond issue ratified by the electorate.

Washington's Water Front a Disgrace

The District of Columbia wharf committee has reported that "the condition of the water front along the Washington channel is admittedly a disgrace to the National Capital." Except for four wharves, "practically all of the existing bulkhead walls, wharves and buildings used for commercial purposes were built in a haphazard manner by private individuals or corporations with no regard whatever to uniformity." The committee cautions the commissioners that "in any contemplated scheme of improvement of the water front, adequate frontage should be reserved for steamboat passenger and freight traffic."

Let Autumn Contracts for 1922 Road Work

Secretary Hoover has written the governors of the various states asking them to let contracts for next year's work in the autumn instead of postponing them until spring. In this way thousands of men might be sure of employment during the winter; in addition to which the work could be started earlier, much of the material hauled during the winter, and other advantage secured.

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A Promising Development

The formation, by prominent labor union officials, of a new labor organization pledged to correct the most unjust and dangerous features of labor unions, as noted on page 118, is one of the most encouraging signs that could possibly appear at the present time on the industrial and constructional horizon.

The principles involved are broad and definite, and will receive the approval and support of thinking men and women. These principles, briefly stated, are: The open shop; the rights of the public; compulsory arbitration; and, consequentially, the elimination or very great reduction of strikes. If to these sound principles be added one more that we have always maintained is of great importance, namely, the incorporation of all labor organizations and their legal responsibility for all their acts; and another, that production should be increased and improved, never restricted; industrial relations founded on them will become beneficial and satisfactory to all concerned, mutual appreciation and co-operation between labor and capital will be attained, and great progress and prosperity will result.

The fact that the new movement is sponsored almost entirely by labor union officials is strong presumptive evidence that the honest and intelligent labor element is at last determined to repudiate and actively resist the propaganda and actual crimes of walking delegates, radical elements, bolshevists and I. W. W. affiliations who, especially of late, have, in many cases, overwhelmed the conservatives and carried out policies disgracing the unions and working immense damage to the whole country. The public, formerly sympathizing with labor, has at last recognized the dangerous abuses and a strong feeling antagonistic to militant unions has increased to a point that makes action of this sort the best possible thing for the unions themselves.

The Development of a Rational State Highway Policy

The state of Connecticut, with an assessed valuation of nearly $2,000,000,000, has 12,000 miles of highways connecting its 168 towns, many of which are active manufacturing centers, including important trunk lines, such as the New York Post road and others. There are about 450 miles of stone and bituminous macadam, 175 miles of concrete of all sorts and about 1,000 miles of gravel, stone and earth or their combination, leaving a balance of 10,400 miles unimproved.

During the first years of its existence, the State Highway Department provided improved hard-surface roads at a cost of a few thousand dollars per mile, that answered all the then present and anticipated requirements, but with the advent of automotive vehicles existing roads on the trunk lines were found entirely inadequate and were rapidly destroyed and new roads were demanded, costing approximately ten times as much as the old roads for their construction.

There was immediately presented the new problem of raising and properly expending many millions of dollars for construction, reconstruction and maintenance of roads that, although they quickly created a vast actual and potential increase in wealth, required in advance unprecedented expenditures that could not be borne by or justly assessed on either the local residents or on the state as a whole. It was therefore determined to place as large a proportion as possible of the cost on the automotive vehicles which necessitated and were principally benefited by the outlay.

A careful analysis of official data combined with a survey of the actual benefits and profits derived by the vehicles and consideration of the benefit to the general public finally resulted in the imposition of a yearly tax of $187.50 for a 5-ton truck, which, although only about 1/3 as much as was considered automatically justified will, when added to the other resources of the highway department, provide for an increased amount of construction and maintenance that, in 1921, will

amount to approximately $7,000,000, and that allowing for a probable decrease in automotive vehicles in the near future will allow an average budget of about $6,000,000 for the next two years.

No hard and fast rule has been adopted for the type of roads to be reconstructed, but it is anticipated that about one-third of them will be concrete and that less expensive types will be used where they will be equally satisfactory under less exacting traffic conditions.

The construction and maintenance policies are co-ordinated with a control system that regulates the traffic so as to divert, suspend or limit it on certain roads when it would be injurious and to provide for heavy traffic under restrictions, thus maintaining proper routes at all times and saving roads from serious injury under adverse conditions.

Labor Wages Approaching Normal

A special report to PUBLIC WORKS from the Water Works Department of the city of Waynesboro, Ga., states that at the present time the rate paid there for common labor is $1.10 per 10-hour day. In 1914 it was $.83 for a day of the same length. When a similar ratio is widely enough established in other parts of the country there will be no delay or doubt of enormous increase in construction.

Boston High Pressure Water System

For several years the installation, now nearing completion, has been going on for the separate high pressure water supply system to protect the business part of the city of Boston from fire danger. The first mechanical installation of the equipment to operate the pressure system has been installed in the Boston Elevated Railway Power Station at Commercial street where space has been secured and provisions made for general supervision of the plant that will afford the necessary shelter and attention at a very small additional expense. There are here two steam turbine-driven 3-stage centrifugal Worthington pumps, with a capacity of 3,000 gallons per minute at 300 pounds pressure and 4,550 gallons at 200 pounds pressure. They are supplied from two 16-inch suction mains, one connected with the Boston low-service system and one with the high-service system and from a third 16-inch main delivering salt water. They are all cross connected to two 16-inch discharge mains insuring a high pressure supply from either one of three sources for either of the two outlets by means of either of the pumps, thus providing against almost any possible combination of accidents.

The No. 2 installation at the Edison Illuminating Station, on Atlantic avenue, opposite Pearl street, has two motor-driven 4-stage centrifugal pumps, each with a capacity of 3,000 gallons at 300 pounds pressure and 4,550 gallons at 200 pounds pressure, or 7,000 gallons per minute at 175 pounds pressure. They are similarly supplied from separate low-pressure, high-pressure and salt water mains and discharge through two separate 16-inch mains. The station has a very large storage battery capacity and, like Station No. 1, has sufficient vacant room in reserve to permit the future installation of a third pump if necessary.

Station No. 3 at the Edison Illuminating Company's Station on Stewart avenue for two electric units similar to those at No. 1 and No. 2 will have the same equipment installed as the previous ones, with the exception of the salt water supply, which will be omitted there.

The two discharge mains from each station are for alternate operations as a duplex distribution system and are provided with extra heavy pipes, in which the unbalanced pressure is cared for by joints made with 95 per cent lead and 5 per cent tin, developing sufficient strength so that no ties are required.

The alloy metal, which is used only on unbalanced joints, is 3½ inches deep and is compacted with dog sets, one man holding the caulking tool and the other man using a 4-pound hammer, finishing with a lighter hammer. These joints were developed to avoid the risk that was occasioned by the gradual rusting away of the wrought iron tie rods, which were found in some cases to totally disappear in eight years. On straight work the regular lead joints are used.

Every pipe was subjected for one hour to a test of 400 pounds pressure before the joints were covered, and the leakage in the last 20 minutes of the test was measured and was found to be less than the permissible amount of 2 gallons per linear foot of pipe joint for 24 hours.

The high-pressure system contains approximately 12 miles of 16 and 20-inch mains and it has about 300 hydrants in the district having the highest fire hazard.

Board of Appeals in Zoning*

General conclusions applicable to all states and cities. Appointment and powers of New York Board of Appeals.

The main difficulty in establishing a zoning plan is to make it effective and at the same time avoid arbitrariness. Human wisdom cannot foresee the exceptional cases that can arise in the administration of a zoning ordinance. The strict word of the law may sometimes be the height of injustice. No zoning ordinance standing by itself can provide for the proper adaptation of the spirit of the law to each exceptional case. On this account, in the administration of building laws in general and especially zoning ordinances, it has been found desirable, even necessary, to create an expert board, usually called a board of appeals, to adapt the application of the law to particular exceptions so as to carry out the spirit of the law instead of allowing it to be arbitrary or confiscatory. A city cannot create such a board

*Excerpts from a paper by Edward M. Bassett, counsel of zoning committee, New York City.

without authority from the state legislature to do so. Therefore any state enabling act to authorize cities to adopt zoning ordinances should contain a provision empowering the city to appoint such a board and outlining its functions. Merely to say that a city can appoint such a board to do what is just and lawful is not enough, and probably such a statement in the law gives the board no power whatever. The state enabling act must either prescribe the rules that it must follow or better yet empower the city council to assign to it in the ordinance certain specified classes of exceptional cases for it to decide. The council should also prescribe a rule for it to follow in deciding each class of cases. Such a board should be given three distinct fields, first, to rectify errors in granting or refusing permits, secondly, to pass on exceptional cases where specified in the ordinance itself, and third, to vary the literal requirements of the law where unnecessary and excessive hardship is caused and the intention of the law is equally accomplished by an alternative method to be prescribed.

The state enabling act should provide for the review of the decisions of a board of appeals by the court. This court review, however, should not be a substitution of the judgment of the court for the judgment of the board of appeals. The findings of an expert board should not be interfered with by the court unless the board has exceeded its lawful powers or misinterpreted the law or abused its discretion. In states where under such circumstances the courts will not assume this position, the enabling act should require it.

A board of appeals may well be composed in part of officials whose duties bring them in touch with buildings and their use throughout the city, and in part of non-officials expert in such fields as design, construction, fire protection or sanitation. As a rule the official who issues permits in the first instance should not be a member of the board of appeals because it is better that he should not be compelled to act on his own prior decisions. Neither should a member of the city council be on the board because of the difficulty of his acting as a legislator in one position and as an administrator in the other.

States and cities will not go far afield when they come to define the functions of the council and the board of appeals if they will remember that the council is the city legislature and as such has entire control over the zoning ordinance and maps. The board of appeals should have no control over the ordinance and maps, but should pass on specific permits arising under the provisions of the ordinance and maps. The council then has its own field and the board of appeals its own separate field, and these do not overlap. The council does not adjudicate on a particular building or the use of a particular building. The board of appeals passes on nothing but particular buildings. The council impresses a certain quality on the land itself. The board of appeals in certain exceptional cases varies the application of the ordinance for a building or use which temporarily occupies the land.

Wherever the application of a zoning ordinance is arbitrary the courts are likely to declare it void in that particular. After an ordinance has been declared void in five or six particulars it has little binding force. Just here is where the need of a board of appeals comes in.

No words of a written law can prescribe what ought to be done in thousands of exceptions which can arise in the construction and use of buildings. The council of a large city cannot and ought not to give its time to granting specific permits for buildings.

The ordinance and maps should be comprehensive and when altered the alterations should apply comprehensively and not be limited to a single building or plot. Some board that can investigate the environment, view the plot or building if necessary and express an expert opinion on the situation, should in proper cases under the guidance of the rules laid down by the council be given power to vary the strict letter of the law. . . .

The city of New York at last obtained the board of appeals as an adjunct to its zoning plan. The board has risen to a position of dignity and importance. Fully three-fourths of its cases arise under the zoning resolution. It publishes a weekly bulletin giving its calendar and decisions. The questions that it passes upon equal in magnitude and importance the cases that come before the trial courts. Its chairman and staff give all of their time to its work, make inspections and transact an amount of detail work regarding buildings and uses that it would be quite impossible for a city council to cover. Its members are presumed to be experts in buildings and their uses. They are quite uniformly supported by the courts.

. . . The board consists of the fire commissioner, the superintendents of buildings, the chief of the uniformed force of the fire department and six other members appointed by the mayor.

"At all times there shall be among the appointed members of the board persons qualified as follows: One, other than the chairman, shall have had not less than ten years' experience as an architect; one, other than the chairman, shall have had not less than ten years' experience as a structural engineer; one, other than the chairman, shall have had not less than ten years' practical experience as a builder. The mayor shall designate one of the appointed members of the board as chairman and shall also appoint a secretary."

. . . The charter and zoning resolution did not make the board of appeals a court to exercise its discretion over the entire field of zoning. It has the following powers regarding zoning and no more:

(a) To rectify on appeals the errors of building superintendents and other administrative officials in passing on applications for permits;

(b) To decide border-line and exceptional cases where specified in the ordinance;

(c) To vary the literal requirements of the law in individual cases where unnecessary and excessive hardship is caused and the intention of the law is equally accomplished by an alternative method to be prescribed by the board of appeals.

Lights and Shadows of the Activated Sludge Process†

By Harrison P. Eddy*

Developments up to date; description of process, theory of its operation, extent of purification accomplished, effect of temperature, re-aeration and other details.

It is the object of this paper to touch briefly upon a few of the most interesting features of the activated sludge process and to point out the facts which have been rather thoroughly demonstrated and of which we are comparatively certain, and to indicate those which are still in doubt and upon which more investigational work and experience are required to determine the natural laws which govern and to perfect methods of procedure. In venturing to classify certain conditions as established facts, it is recognized that the process as a whole is still in the experimental state, that there are many conditions under which it has not been tested, and that circumstances may exist under which those features which we now feel are clearly understood will present unexpected difficulties and uncertainties.

DESCRIPTION OF ACTIVATED SLUDGE PROCESS

For the benefit of those who have not given particular study to this process, it may be well to state briefly, in a general way, what it is and what it is capable of accomplishing.

When sewage containing a suitable supply of dissolved oxygen is agitated for a sufficient length of time, the fine suspended matter and the colloidal substances here gather into small aggregations called flocculi or floc.‡ When the sewage thus coagulated is permitted to stand quiescent, this floc quickly settles and forms at the bottom of the basin a very thin mud or sludge. The sludge is then withdrawn, and normally contains about 98 per cent water. If such sludge be introduced into sewage, the rapidity with which the suspended and colloidal matters are coagulated may be greatly increased.

Thus the process as ordinarily carried out consists of adding sludge to the sewage, in proper proportion—roughly 1 to 5—introducing sufficient air to provide enough dissolved oxygen to maintain aerobic conditions, and agitating the mixture until practically all of the fine suspended and colloidal matter has been flocculated or absorbed by the floc introduced into the sewage. The mixture is then conducted to settling basins where the floc is removed by sedimentation and the clear supernatent water passes away as effluent. That portion of the sludge which is not required for the treatment of incoming sewage is diverted to sludge lagoons or it may be conveyed to a dewatering and drying plant where it can be converted into material suitable for use as a fertilizer base.

By this treatment sewage and many industrial wastes can generally be clarified and purified to a marked extent.

THEORY OF PURIFICATION

The first and perhaps most noticeable function of this process is that of coagulating or flocculating the suspended and colloidal matters in the sewage. This action is similar in effect to the well-known chemical coagulation with sulphate of alumina or sulphate of iron and lime, and the floc resembles the chemical coagulum, particularly the ferric hydrate from the sulphate of iron and lime treatment.

The floc is a sponge-like mass or an open-mesh network which in the process of formation may envelop, entrap or entrain colloidal matter and bacteria. The sponge-like structure of the floc offers a very large surface area for contact, and this floc appears to be able to absorb colloidal matter, gases and coloring compounds. When the floc is driven about in the liquid it has a sweeping action by which the colloidal substances may be said to be swept out of the water, or as stated by Philip Morley Parker, the "process may be regarded as passing a filter through the water in place of passing the water through a filter." Thus far the process appears to be primarily of a physical nature. It has been demonstrated, however, that it cannot be carried out under sterile conditions.

Just what the action of bacteria and other organisms may be, is a subject which should receive further investigation. One plausible theory is that the bacteria which are contained in the cell-like structure of the floc, feed upon the very finely divided matter and thus relieve the floc of its burden of such substances and restore its faculty of absorption to such an extent that when introduced into the incoming sewage the floc efficiently performs its function of absorbing the colloidal matter which will again be consumed by the living organisms which thus cause its regeneration. Because of these properties the sludge has come to be called "activated sludge," a term suggested by Ardern & Lockett.

One of the cardinal principles of this method of treatment is that there must be dissolved in the

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†Paper before the Western Society of Engineers.

‡The word "floc" as used herein, signifies a single sponge-like mass or an aggregation of such masses.

sewage an ample supply of oxygen to maintain aerobic conditions. The action of the organisms in consuming the colloidal matter is one of digestion or oxidation—sometimes referred to as "moist combustion." Through this action the actual weight of suspended and colloidal matter is reduced, the products of the combustion being carried off in the form of dissolved or gaseous matter. This process, under favorable conditions, may extend to nitrification, by which substantial quantities of nitrates and nitrites are formed. Nitrification, however, is not necessary to the maintenance of sludge activity, as seems to have been the opinion at the outset.

EXTENT OF PURIFICATION ACCOMPLISHED

One of the bright spots in the experience with activated sludge is its high efficiency as a process of sewage purification. This much at least may be said to be well established. At Houston, Texas, it is stated by City Engineer McVea, that "fish have lived in the outlet chamber (effluent) for more than a year."

So large a portion of the suspended solids and colloids may be removed that under ordinary conditions the effluent will be clear and contain but very little suspended matter; from 5 to 20 p. p. m., as a rule.

The sweeping process by which the colloids are absorbed, or coagulated, is also effective in reducing bacteria—not by destroying them but by physically removing them.

In many cases color may also be removed, probably by action similar to that of mordants.

In the case of odors, some may be oxidized directly and some absorbed, the resulting effluent being comparatively free from odors noticeable to the ordinary observer.

Oxidation of organic matter in solution occurs coincidentally with the flocculation, and there may be nitrification where the treatment is fairly complete. In the latter case the treated sewage may be charged with a substantial quantity of available oxygen in the form of nitrates and nitrites, which will serve as a factor of safety against future putrefaction.

An interesting characteristic of this process is its adaptability to partial treatment. If the removal of colloids and bacteria and the production of a moderate degree of stability be sufficient, the process can be stopped short of material oxidation of organic matter and nitrification. On the other hand, if complete stability and oxidation of a substantial portion of the dissolved organic matter are required, the process can be so operated as to accomplish this, at least in many cases. As early as 1917, T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, determined upon the following standard as a measure and limit of purification to be effected by the activated sludge process at Milwaukee:

Reduction of bacteria .....90 per cent
Reduction of suspended solids 95 per cent
Stability by Methylene blue ....72 hours

Prolonged tests with the strong sewage containing a substantial proportion of industrial wastes have demonstrated that it is entirely practicable to meet this standard at Milwaukee.

While it may be proper at the present stage of development to assume that in general purification may be carried to almost any extent desired, it is important to consider carefully the character of the sewage or wastes to be treated for there may be disturbing influences similar to those which appear to have been important at Worcester. There—probably because of the acid iron wastes from the wire mills—the extent of purification was decidedly limited, notwithstanding the use of very large quantities of air, a goodly period of aeration and re-aeration of the sludge.

The late Matthew Gault concluded that Wormester sewage is apparently of such a character that nitrification does not take place readily and that it would be practically impossible to operate so as to constantly obtain uniformly good results. It may be noted, also, that nitrification does not readily take place when this sewage is treated by intermittent filtration.

AERATION

The aeration feature which has been more generally studied than any other portion of the process, as at Milwaukee, Cleveland, Worcester, and Packingtown, and Stockyards in Chicago, and elsewhere, apparently is comparatively well understood.

Air is utilized for two purposes—for maintaining aerobic biological conditions and for agitation. Agitation, however, may be accomplished by other means, such as purely mechanical devices.

The oxygen requirements for the support of aerobic conditions are relatively small. Crawford and Bartow found that only about 5 per cent of the oxygen of the air used for aeration, appeared to be utilized, basing their conclusions upon analyses of the air entering and the gases escaping the aeration tank. The writer found only 10 per cent of the oxygen disappearing in the case of strong tannery wastes. If the oxygen supply is to be obtained from air blown into the sewage, there must be sufficient opportunity for the sewage to dissolve out the oxygen while the air is passing through it.

The quantity of air required for agitation is very large. It is necessary to provide sufficient agitation to prevent the heavy suspended solids from settling down on to air diffuser plates and thus clogging them. Removal of suspended matter by fine screening is a substantial aid in preventing such trouble. Even sewage which has passed a fine screen having openings ⅛-inch by 2-inch, may contain sufficient solids of this character to cause clogging of plates if the air supply be permitted to fall much below 1 cubic foot per minute per square foot of plate area. By finer screening it might be possible to reduce this quantity slightly. Whatever be the character of the sewage, the volume of air used must be sufficient to prevent any accumulation of solids upon the diffuser plates.

The volume of air required for aeration is mainly dependent upon the following general conditions:

Composition of sewage to be treated.
Quality of effluent desired.
Period of aeration.

Proportion of sludge to be returned to the sewage.

Temperature of aeration.

COMPOSITION OF THE SEWAGE

The composition of the sewage has a very material effect upon the volume of air required to maintain aerobic conditions and to provide suitable aeration. A strong sewage, or industrial waste, requires more air than a weak one, not because of the direct action of the oxygen on the organic matter, but because there is a greater quantity of colloidal matter to be absorbed by the coagulum and in some cases also because of the larger quantity of dissolved organic matter to be oxidized. The larger the quantity of colloidal matter the greater must be the effective absorbing surface. This may be afforded by increasing the proportion of floc in the liquid or by increasing the period during which the flocculation is continued. If the volume of return sludge be increased, bacterial digestion will be greater and consequently the quantity of dissolved oxygen must be larger in order to maintain aerobic conditions. Furthermore, the digestion of the absorbed colloidal matter and the reactivation of the sludge will require more intense and more prolonged bacterial action in the case of the stronger liquid, thus requiring a greater supply of oxygen for biological purposes.

It may therefore be necessary, with the stronger sewage, to prolong the period of aeration. Such a course naturally increases the quantity of air required for oxidation.

For these reasons and many others, it is important to consider the composition of the sewage to be treated. In addition to the strength of sewage, it is necessary to consider the effect of particular characteristics, such as turbidity, the nature of the organic matter—whether relatively stable or easily decomposed—and the effect of chemicals from industrial wastes, such as acids and alkalis. A relatively fresh sewage may be low in turbidity, and therefore comparatively easily coagulated and oxidized. On the other hand, certain industrial wastes such as those from stockyards and tanneries, may contain such large quantities of colloidal matter as to require prolonged treatment for their removal. Some industrial wastes such as the pickling liquors from the wire mills at Worcester, Mass., tend to inhibit bacterial action and thus increase the required period of aeration or volume of air, or both. It is necessary also, as found by Mr. Fuller, that a sufficient quantity of floc-forming material be present in the wastes. Otherwise such matter must be added in order to secure the desired result.

THE QUALITY OF EFFLUENT

The quality of effluent to be produced has an important bearing upon the quantity of air required. In the case of domestic sewage and some industrial wastes it is possible to secure clarification with a lower expenditure of air than would be required to produce a stable effluent. On the other hand, with some industrial wastes high in turbidity, it may be impossible to secure clarification without at the same time producing a practically stable effluent. The extent of oxidation will, however, increase with increasing volume of air used. It has also been demonstrated that the aeration process must be carried far enough to secure reasonably good clarification in order to produce a sludge of such character and density as to permit satisfactory sedimentation, handling and dewatering. Otherwise the operation of the plant will be difficult, if not impracticable. Within the limitations suggested, it is feasible to limit the degree of purification and consequently the quantity of air required, in accordance with the quality of the effluent to be produced.

PERIOD OF AERATION

The period of aeration has been found to be a very important factor in the quantity of air required. Within limits, the volume of air will decrease with increasing period of aeration. Comparative tests have indicated that with a period of 8 hours only about one-half as much air is required as with a period of 4 hours. With the longer period of aeration, however, the rate of air supplied must be sufficient to maintain proper agitation and prevent the deposition of solids upon the air diffusers, as already pointed out. Where the sewage or wastes contain an abnormally large quantity of colloids, it may be absolutely necessary to provide a long period, such as 8, 12, or even 20 hours aeration in order to remove the colloids and produce an effluent having a moderately high stability. If an unnecessarily large proportion of sludge be returned, or if the period of aeration be unnecessarily prolonged, excessive quantities of air will have to be provided.

TEMPERATURE

Temperature has an important influence upon aeration. Very high or very low temperature of the sewage is detrimental. The unfavorable effect of low temperature has been repeatedly demonstrated. This effect may be in a measure, although probably not entirely, offset by increasing the volume of air. Fortunately in many cases the stream requirements are less exacting during cold weather than at other seasons of the year, and consequently it may be permissible in some cases to discharge a somewhat inferior effluent during the winter, and thus avoid the necessity of increasing the air supply.

For ready estimation of the quantity of air which will be required for biological action and for agitation, more data are needed than are now available. While the strength of sewage has a very important bearing, a comparison of the results of analyses with the quantity of air used at the several activated sludge plants, with a view to demonstrating this relation, is very disappointing. This is because of differences in methods of chemical analysis, lack of important determinations in some cases, differences in methods of operation, and many other dissimilar details. There are so many of these unharmonious features that it is only by a detailed study of each case, and a comparison of the conditions with those of the project under consideration, and the exercise of judgment, that it is possible to arrive at a safe estimate.

As a general statement, where the aeration is carried out in continuous-flow tanks of 10 to 15

feet depth, with area of diffuser plates in proportion of 1 to 6 of tank area and a period of aeration of about 6 hours, the quantity of air may be about as follows:

For rather weak domestic sewage.....1.0 cu. ft. per gal.
For strong municipal sewage containing some industrial wastes not particularly detrimental to bacterial life.....1.5 cu. ft. per gal.
For weak municipal sewage containing considerable industrial wastes some of which are detrimental to bacterial life, as for example acid-iron wastes.....2.0 cu. ft. per gal.
For strong municipal sewage containing considerable industrial wastes some of which are detrimental to bacterial life, as for example, acid-iron wastes...4.0 cu. ft. per gal.
For municipal sewage containing sufficient industrial wastes not specifically inhibitive of bacterial life, to decidedly influence the composition of the sewage, e. g. packinghouse, tannery, etc..3.0 cu. ft. per gal.
Strong packinghouse wastes.....4.0 cu. ft. per gal.
Strong tannery wastes containing a very large proportion of colloids but settled before aeration .....6.0 cu. ft. per gal.

RE-AERATION OF SLUDGE

The evidence is conflicting as to whether there be advantage to be gained from sludge re-aeration. If the sludge is dense, i. e., contains 2 per cent to 3 per cent solids, the air appears to accumulate in large bubbles and escape from the surface at irregular intervals. This tendency seems to render the air less effective as a means of agitation and possibly interferes to some extent with the uniform distribution of the dissolved oxygen throughout the sludge. A test at Milwaukee indicated that there was not sufficient advantage to warrant the adoption of this feature.

On the other hand, Pearse found that in the treatment of Packingtown sewage the return of re-aerated sludge showed "somewhat smaller requirements in the amounts of air needed, and a reduced volume of sludge to be returned."

If the rate of air supply be uniform throughout the 24 hours the lower flow of weaker sewage at night will permit the sludge to become more thoroughly activated than during the day-time and in effect accomplish the end sought in the re-aeration of the sludge by treatment in separate tanks. Similarly on Saturday afternoons, Sundays and holidays the sludge may be revived by appropriate treatment. This result is obtained in practice and has been very noticeable and beneficial in some cases.

PECULIARITIES OF FLOC

The little sponge-like aggregations of fine suspended and colloidal matters have no regularity of structure but as merely masses of independent particles held together by slight forces of attraction. They are of great size in relation to the weight of the solids composing them. The forces by which the particles are held together are so slight that the sludge must not be very vigorously agitated or the floc will be broken up. This is readily demonstrated by shaking a portion of the flocculated liquid in a bottle, when the floc will be seen to revert to the colloidal condition. Hence it is necessary to avoid intense agitation in aeration tanks and to induce as little violent agitation as practicable when pumping and otherwise handling the sludge or the sewage after the sludge has been introduced into it.

The character of the floc varies greatly under different conditions. That produced by thoroughly aerating sewage for such a period of time and under sufficiently favorable conditions as to produce a highly purified effluent will usually be of a golden-brown color, relatively compact and heavy, and will settle with surprising rapidity. On the other hand under-aeration will produce a light, voluminous floc which will not settle as rapidly and which will form a very voluminous sludge of high water content and correspondingly difficult to handle. Under-aeration may be due to furnishing too little air or to too short a period of aeration due to crowding too great a volume of sewage through tanks provided with the proper air supply and period of aeration for a small quantity of sewage. The effect of low temperature is similar to that of under-aeration and in northern climates there is usually greater difficulty in producing a good sludge in winter than during other seasons. Such a condition may be caused temporarily by the introduction into the sewers of cold water from melting snow. An activated sludge plant should be designed with an adequate factor of safety to meet such conditions.

It is just as important to avoid over-aeration, for this results in a re-solution of the floc into colloidal matter with a consequent poor effluent.

The condition of the floc is very dependent upon the sedimentation process. If the sludge is allowed to remain too long without air it loses its activity and becomes septic. It is therefore important to provide for the removal of the sludge from the sedimentation tanks as promptly as is consistent with the proper concentration—in fact, the extent of concentration is limited by the need of maintaining the sludge in good condition.

DURABILITY OF DIFFUSER PLATES

It will be remembered that during the early tests porous plates used as air diffusers became more or less disintegrated within a relatively short period of time. In other cases such plates became so seriously clogged that the pressure necessary to force the required quantity of air through them became prohibitively great. This was due in part to impurities in the air and in part to rust or other material from the plate holders, which gradually sealed the pores of the plates. At Houston, Mr. Fugate has found that porous plates clogged with rust can be cleaned by immersing them in hydrochloric acid at 98 degrees Centigrade.

Improvements in the manufacture of plates appear to have overcome danger of disintegration, and experience during the past three years has demonstrated that it is practicable to so purify the air and construct the plate holders as to avoid danger of clogging within a short time. The period covered by this experience, however, is too short to show how long a life such plates will have. However, in view of the fact that after continuous use for a period of about two years there is no marked increase in the pressure required to drive the air through the plates, the assumption seems to be justified that the plates will have a useful life of a number of years, certainly as many as five years and possibly a very much longer time.

(To Be Continued)

Construction Questions Answered

How to Handle and Erect Girder Spans Without Special Equipment III*

With fixed and moveable derricks.

Up to about 30-feet span, highway girders can be unloaded, stored, shifted, reloaded, and erected in position by one or more ordinary builders' derricks; spans of more than 30 feet, up to the ordinary limit of highway girder construction, can be handled in the same manner by larger, stronger derricks, without the use of other plant for either long or short spans.

Derricks are universally a part of the general contractor's equipment, are to be had in almost all localities, so that they can be purchased or rented under most circumstances and if not can be easily constructed from imported or native timber rigged with wire or manila rope and standard fittings purchased from dealers, or their equivalent that can be manufactured by any capable blacksmith and machinist. This enables derricks to be constructed in very remote localities, where the delay and expense of shipment is an objection to sending them complete from the contractor's yards or the manufacturer's shop.

If a large number of spans are to be erected in one place, as, for instance, in the construction of a long girder viaduct or if only a single span is to be erected at a point distant from any other construction work involving the use of derricks, the situation should be carefully studied with a view of devising some means of handling and erecting that will involve the lowest total cost, although the expense for the single span will be much greater than for one of a number of spans erected by special methods and apparatus. In other cases it will very often be found most convenient and economical to handle and erect the girders with whatever derricks are most available.

The great advantages of derricks for girder erection are their simplicity, flexibility, ease of installation and removal, wide range of application, rapidity of action, general availability and the universal familiarity that most contractors and their employees have with their use.

TYPES AND RIGGING

Derricks may be stiff-leg or guyed, fixed or moveable, of wood or steel, and of any dimensions and capacities from a 15-foot, 2,000-pound boom of a miniature jinniwink derrick to a 100-foot boom with a 50-ton capacity. They may be made of wood or steel, may be rigged with steel or manila rope, and may be operated by hand or by steam, compressed air, electric or gasoline engines. The hoisting engines are generally of standard derrick type and of late years the steam engines are very often run by compressed air, in order to eliminate the use of coal and installation of the boiler plant and the employment of a licensed engineer. Some derrick hoists are operated by electric or gasoline motor that consumes no fuel when not in operation and are very simple in their function.

Jinniwinks are very small, light, stiff-leg derricks, permanently attached to their sills that form skids on which they are easily moved from place to place. They are quickly shifted, have independent stability and are often operated with hand windlasses or very small motor hoists. They are chiefly used for handling light loads, like single I-beams, small columns or struts and are very convenient for use in the erection and removal of large derricks. They are suitable for assembling light floors and braces after the girders are erected and can even handle small size girders.

The ordinary minimum guy or stiff-leg derricks have a boom about 25 feet long of at least 5,000 pounds capacity. Derricks with 50-foot booms of 8-ton capacity are very common and can easily be made with ordinary fittings. If the length or capacity of the boom is greatly increased it is necessary to have special design, construction and operation.

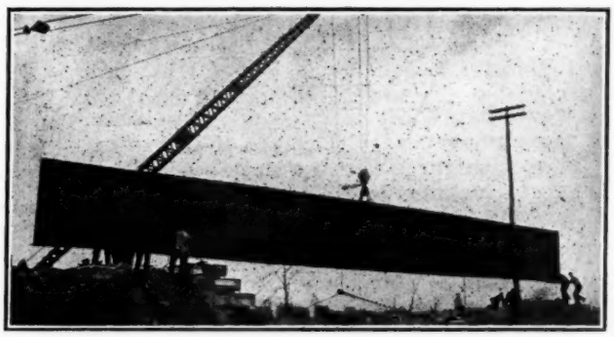
Standard fittings are likely to be safe for loads up to 10 tons; for very heavy loads, tremendous direct and eccentric stresses may be developed, necessitating very careful design, fabrication and assembling. For light loads, wooden derricks and manila lines are suitable, for very heavy ones, steel derricks with section adjustable booms and masts rigged with steel ropes, are generally used. They are not often included with the equipment of general contractors, except those who specialize in the erection of steel work and other heavy construction. They can, however, sometimes be secured by small contractors from large contractors, bridge shops, railroads and others maintaining extensive plants, but it is to be borne in mind that their transportation, erection and removal are very expensive, require the services of an expert and should not be attempted unless necessary.

The first derrick installed is usually erected by the aid of a ginpole, sheer legs, or equivalent device, with which the mast is hoisted and maintained until securely guyed in position, after which a tackle suspended from the mast can be used for erecting the boom and, in the case of a stiff-legged derrick, the stiff-legs, sills and braces. If a traveling derrick is erected it can, of course, be used for the erection of all the other derricks.

It is essential that a guy derrick shall have at least four guys, and for heavy work six or eight are preferable. Their lower ends must be secured to abundant reliable anchorage, to which they

*Part I—Transportation to site and erecting by steam protrusion was published July 3d.

Part II—Erection by cribbing, jacking, rolling and skidding was published July 30th.



ERECTING WITH SINGLE DERRICK AND FLANGE HOOKS

may be made fast directly or, in the case of heavy work, sometimes through a convenient adjustment such as a small tackle or turnbuckle. The sills of stiff-leg derricks are usually loaded with the hoisting engine, boiler, fuel supply or any convenient counterweight to give them independent stability.

Stiff-leg derricks may be easily made moveable by seating the mast and stiff-legs on, and rigidly connecting them to, the horizontal sills forming the framework of a platform that is mounted on trucks or single wheels running on a broad-gauge track that enables the derrick to travel freely from place to place either by pushing it or by the hoisting engine operating a line anchored in advance.

Before putting into service, the mast, boom and fittings should be very carefully inspected, timbers should be bored to detect indications of decay, and the wire or manila rope be very thoroughly examined for defects. These should be oiled, the tackles carefully rove, and the hoisting engine overhauled, cleaned and tested. Whenever the derrick is left idle over night or for holidays the boom should be carefully secured against meddlers and before commencing work the guy and anchorages and hoisting tackle should be carefully examined to see that they have not been accidently or maliciously injured.

HOISTING CONNECTIONS

When girders are handled by derricks special attachments are necessary to connect them to the hoisting tackle. The use of chains for this purpose should never be permitted, but wire or manila rope slings properly made and adjusted may be used instead. Where there is much handling of girders to be anticipated it is desirable to have a pair of bent-plate hooks attached to the hoisting tackle. These should be of proper size and strength to be attached to the top flange of the girder and should be provided with a lock bolt to secure them in position.

If clamp hooks are not available or if special reasons require it, girders may be handled by yokes made of a pair of cross pieces and two screw bolts clamped tightly around them and provided with an eye-bolt or other device suitable to receive the hoisting tackle.

If the girder is to be handled by a single derrick, care must be taken to attach the hoisting tackle at exactly the center of gravity. If two derricks are used the tackles may be attached at opposite ends of the girder or at equal distances from the center if they are required to carry equal parts of the load, but if not, one derrick may be attached by one end to carry the lightest part of the load and the other at a distance from the other end proportionate to the excess load that it is intended to carry.

If possible, the derrick booms should be raised or lowered to the required height before lifting the girder. Care should be taken in operating the tackles when it is necessary to raise or lower the loaded boom. Two lag lines should be attached in opposite directions to each end of the girder, four in all, to enable it to be controlled while in the air and the derrick boom may be swung while loaded by lag lines attached to it or by a line from its bull wheel to the engine if it is operated by power.

Fastenings of steel rope are always made with rope clamps or clevis sockets. Manila lines are secured by standard hitches familiar to all riggers and described in many engineer handbooks. The half hitch is the commonest fastening, is very easily made and when two or three times repeated is very secure on a taut line and will hold small objects. The becket hitch is merely two half hitches made backwards, and is much used for fastening the end of a line to a pulley block. It will not undo and the free end does not require lashing. This hitch is apt to jam, so the line must be cut to release it. The jury mast hitch is used to secure guys to a derrick head. A double bowline hitch is very convenient for a seat for a man hoisted to the top of a derrick.

ERECTING 39-TON GIRDERS

The Torresdale Avenue highway bridge over Frankford creek, Philadelphia, has plate girders 86 feet 8 inches long that weigh 39 tons each.

HANDLING LARGE GIRDER IN POSITION WHERE FLANGE HOOKS WERE IMPRACTICABLE

They are connected by plate girder floor beams 51 feet long.

The girders were hauled to the site with the webs horizontal, supported on bolsters on the axles of two independent trucks hauled by a steam tractor. They were unloaded by a steel derrick of 30-ton nominal capacity that had one steel stiff-leg and one wooden stiff-leg and was rigged with a 9-part hoisting tackle and a 9-part topping lift, both rove with steel wire rope.

In lifting the girder from the trucks it was attached to the hoisting tackle by a pair of heavy chain slings passed around it, one at each side of the center of gravity and enabling it to be picked up flatwise and laid down on temporary support after which the slings were disconnected and the girder revolved into a new position with the web vertical. This position enabled the slings to be replaced by a pair of clamped plate hooks engaging the upper flange at the center of gravity.

The girder was then carefully shifted and swung to position on the abutment with the derrick boom at an angle of about 45 degrees with the vertical, care being taken to watch it closely for signs of incipient failure from the overload. None were observed, however, the girders were safely lowered to position without difficulty. The boom was swung by a line attached to the point, run through a snatch block, anchored to the abutment at the opposite side of the girder and then led to the hoisting engine. The girders were fabricated and erected by the American Bridge Co., J. B. Gimberling, division erection manager.

DETACHABLE INCLINED WAYS FOR DRIVING SPUR PILES, WOOD ISLAND BULKHEAD

Wood Island Bulkhead

More than 1,000 battered piles and nearly as many vertical piles driven 16 feet in hard clay with three floating drop-hammer machines in Boston harbor.

The improvements at Wood Island park, in the harbor at Boston, are being carried on under the direction of Frank W. Hodgdon, chief engineer of the Division of Waterways and Public Lands, Department of Public Work, Commonwealth of Massachusetts, and include the construction of a long wooden bulkhead built by the William L. Miller Company, contractor.

The bulkhead, 2,500 feet long, is required to retain a hydraulic fill 16 feet high above low water level. It is therefore designed to resist a heavy horizontal thrust that is received against the vertical face of a continuous line of 4-inch wooden sheet piles bolted, as shown in the engraving, to rangers on vertical wooden piles 6 feet apart on centers that are driven to a penetration of about 16 feet in the hard clay bottom.

Where the elevation of the bottom is 5 feet or more above low tide, the vertical pile is braced only by a single battered pile, but if the elevation at the bottom is lower, a greater portion of the vertical pile is exposed, the bending moment and horizontal thrust are greater and the pile is braced by two battered piles, as shown in the diagrams,

There are in all about 2,122 piles required, which were delivered by rail and loaded on lighters in lots of about 250, or 5 carloads each. They are all of oak from 6 to 14 inches in diameter and from 30 to 40 feet long. The vertical piles were first driven at the rate of about 36 in six working hours by an ordinary floating machine with 60-foot leads and a 2,400-pound drop-hammer.

After the piles were capped and adzed to receive the battered piles, another one of two floating driver machines handled the piles from the attendant lighter and, resting them on top of the cap piece, spotted and drove them at about the same rate as the vertical piles, with the drop-hammer operating in a pair of inclined ways 15 feet long, framed to slide up and down in the vertical ways of the original machine. The vertical piles were lined in with shore ranges, and measured for position in the ordinary way, and the entire work of framing and driving was done by a force of about 30 men operating the three machines and framing and bolting the piles.

After the battered piles were driven to approximate position and cut off and adzed to the required angle, they were pulled up against the faces of the vertical piles by lines operated by the hoisting engines of the pile driver machines and held there while the bolt holes were bored with augers operated by machines furnished by the Chicago Pneumatic Tool Company and driven with compressed air provided by an Ingersoll-Rand compressor. Each joint is made with two 1¼-inch bolts, having flat washers bearing on notched surfaces.

At the point where the work was done the ordinary variation of tides was about 10 feet and as the draft of the pile driver scows is more than 4½ feet and that of the lighters is 6 feet, there were portions of the day when neither pile drivers nor lighters could be moved, thus considerably retarding the work and destroying it's continuity.

Important Labor Attitude

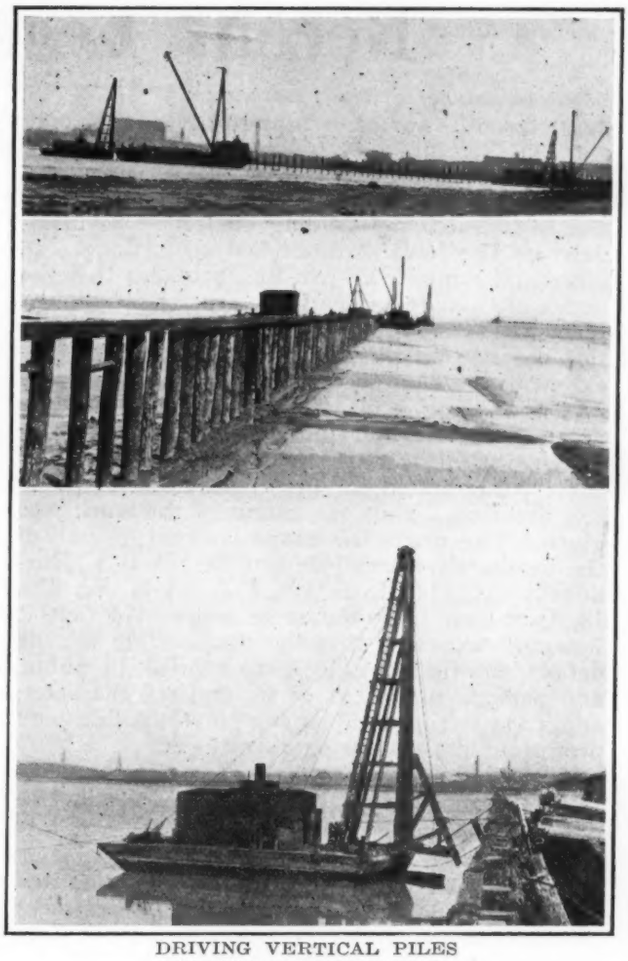
The new constitution adopted July 29 by the Loyal Labor Legion of New York City is so different in fundamental principle from the common practice of the A. F. L. unions that it should arouse great interest and hopes for important good results in that it specifically upholds basic principles that have in practice, and some of them in terms, been opposed by the unions but which are vital to real democracy and liberty.

In particular the new constitution recognizes: (1) The right of men and women to work regardless of membership or non-membership in trade unions. (2) The rights of the general public as a party at interest in labor controversies. (3) The necessity for laws establishing courts of arbitration, with power to enforce obedience to their decision. (4) The settling of differences between employers and wage earners "without interventior by persons not personally affected by or direct parties to the matters in controversy."

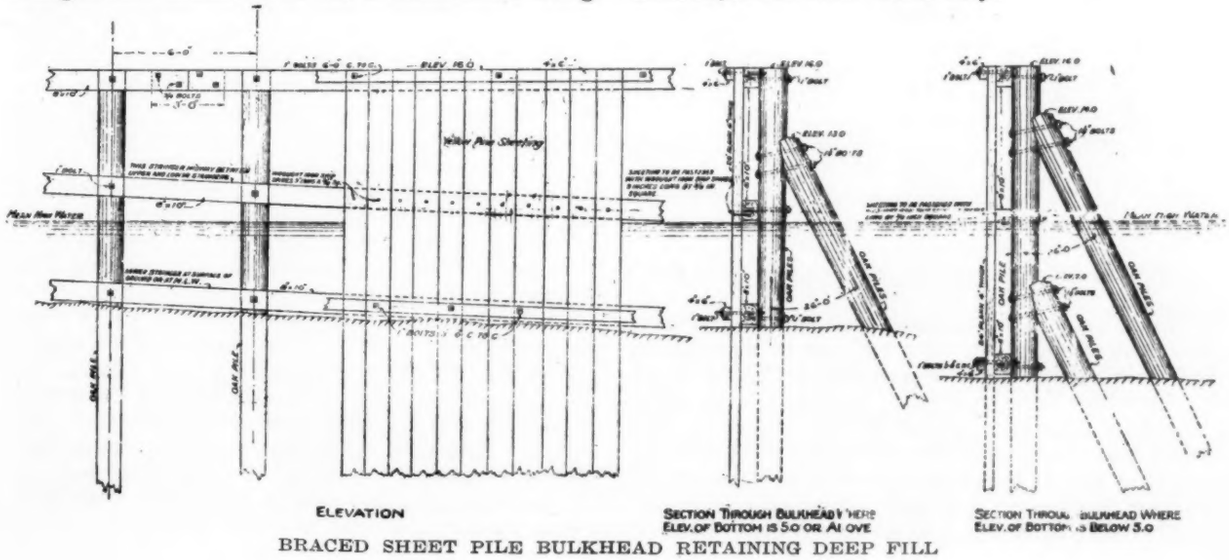
A committee has been appointed to inform trade unions throughout the country of the new principles laid down in the constitution and to devise methods for bringing organized labor into line for their acceptance.

The new organization should wield a strong influence among the labor unions from the fact, as stated by its head, F. Paul A. Vacarelli, former vice-president of the International Longshoremen's Association, that the committee appointed to frame the new constitution was composed of the chairman of the International Union of Steam and Operating Engineers, president of the Loyal Labor Legion and president of the Scow Trimmers' Union, secretary of the Harbor Boatmen's Union, chairman of the American People's League and members of the International Longshoremen's Union and Amalgamated Association of Street and Electric Railway Employees.

It is also stated authoritatively that 90 per cent of the organization's membership is composed of elected officials of American Federation of Labor trade unions, representing a membership of more than 20,000 in New York City.



DRIVING VERTICAL PILES
CAPPING VERTICAL PILES
DRIVING INCLINED PILES


ELEVATION
SECTION THROUGH BULKHEAD WHERE ELEV. OF BOTTOM IS 5.0 OR ABOVE
SECTION THROUGH BULKHEAD WHERE ELEV. OF BOTTOM IS BELOW 5.0

BRACED SHEET PILE BULKHEAD RETAINING DEEP FILL

Recent Legal Decisions

SUFFICIENCY OF NOTICE OF BIDS FOR STREET GRADING CONTRACT

On appeal from the levy of an assessment for grading a street objection was made that the notice of bids for the grading contract was insufficient. The Iowa statute relied upon, Code Supplemental Supp. 1915, par. 813, provides that the notice shall state as nearly as practicable the extent of the work, etc. It was argued that the notice did not do this, since it did not state the extent of the haul necessary in removing surplus dirt or making a fill. The court said that the notice did state the amount of excavation estimated, and in the assessment the same number of cubic yards stated for grading was charged for and assessed. Thus the extent of the work was given. The matter of hauling would be one of the details as contended; but in Nixon v. Burlington City, 141 Iowa 316, 323, 115 N. W. 239, 18 Ann. Cas. 1037, the same court held that it was not necessary that the notice state all the details, and that its office is to apprise the public and persons interested of its general character, and to give opportunity for investigation and protest to those desiring to make it.

The statute also requires the notice to state the terms of payment. It is held this was sufficiently done by reciting in the notice that the cost was to be assessed against the abutting lots in accordance with the law governing the same and that the payment was to be made in assessment certificates or bonds. Royal v. City of Des Moines, Iowa Supreme Court, 182 N. W. 188.

DELAY OF CONTRACTOR IN SECURING EXTENSION OF TIME CURED BY STATUTE

In an action by a contractor to foreclose an improvement assessment, the California Supreme Court holds, Oakland Paving Co. v. Whittell Realty Co., 195 Pac. 1058, that a failure to secure an extension of time on the exact day when the contract expired, or before, is a mere defect or formality in the proceedings, where the contractor has been proceeding diligently day after day as the law and contract provide, and has failed to complete the work within the time which was fixed after his bid to do the work had been accepted, and the informality comes within section 26 of the California Improvement Act, 1911, providing that no proceeding prior to assessment shall be held invalid for any informality in it.

CITY MAY AGREE WITH STREET RAILWAY TO PAVE LATTER'S PORTION OF STREET

When an electric railway company, exercising an easement in a city street about to be repaved and being liable by law and under the terms of its franchise for the cost of paving the part occupied by it, proposes that the city pave the railway's part along with the remainder of the street, agreeing to pay its proper proportion thereof, including the preliminary cost of surveys, etc., upon the same terms as special assessments against abutting property are made payable, the Ohio Supreme Court holds, City of Newark v. Fromholtz, 130 N. E. 561, that the city may accept such proposal and proceed accordingly. Such action is not unconstitutional.

ABUTTING OWNER CANNOT ENJOIN REMOVAL OF RAILROAD TRACKS FROM STREET

In a suit by a taxpayer to restrain the execution of a contract between a city and railway companies for the removal of railroad tracks from a street in the city, with which tracks the plaintiff, whose property abutted on the street, had switching connections, the Supreme Court of the United States holds, Armour & Co. v. City of Dallas, 41 Sup. Ct. 291, that such owner has an adequate remedy at law by the recovery of damages to his property caused by the removal of the tracks, and that the bill for injunction was therefore properly dismissed.

CONTRACTOR CONTRACTING TO REMOVE LOOSE MATERIAL ENTITLED TO EXTRA COMPENSATION FOR ROCK WORK

The Supreme Court of the United States holds, United States v. L. P. & J. A. Smith, 41 Sup. Ct. 413, that a contractor which contracted with the federal government to remove clay, sand, and boulders from a navigable stream, is entitled to extra compensation for the removal of a bed of limestone rock, notwithstanding provisions making the decision of the officer in charge of the work as to the quality and quantity of the work final, and requiring his instructions to be observed by the contractor, and the fact that the engineer ordered him, despite his protest, to remove the rock under the contract.

REQUIREMENT AS TO COMPETITIVE BIDDING MUST BE COMPLIED WITH

In a suit by a city to compel specific performance by a lighting company of its contract with the city, it appeared that the company's street lighting proposal was accompanied by an offer, contingent upon the acceptance of the street lighting bid, to supply commercial lighting and power to the city and its inhabitants at certain reduced rates during the life of the street lighting contract, which was accepted by the city for itself and its inhabitants. The city charter, however, required competitive bidding for the letting of contracts for the expenditure of over $250, and since the commercial contract as respected the city called for an expenditure by the city of more than $250 per month, it violated the competitive bidding requirement, and did not bind the city. The city, therefore, not being bound, could not, by bill for performance, City of Saginaw v. Consumers' Power Co., Michigan Supreme Court, 182 N. W. 146, compel the company to perform the contract as to it, in view of such lack of mutuality of obligation. The city, however, might maintain the bill on behalf of its citizens and the consumers of commercial light and power, to avoid a multiplicity of suits.

NEWS OF THE SOCIETIES

Aug. 10-12—INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS. Annual conference. Hotel La Salle, Chicago, Ill.

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventh annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS, National convention. Springfield, Mass.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Metropolitan section of the society, with a membership of 3,000 has elected W. S. Finlay, Jr., chairman; G. I. Rhodes, secretary; and Robert B. Wolf, treasurer, with A. E. Allen, of the Westinghouse Company, constitute the executive committee.

The Metropolitan section, under which are held public forums on engineering topics, has sub-committees on power engineering, industrial relations, educational manufacturing, production engineering and legislation.

The American Society of Mechanical Engineers announces the appointment of a new committee on relations between general meetings, professional divisions and local sections. The members are L. P. Alford, of New York, editor of *Management Engineering*; Dean Dexter S. Kimball, of Cornell; Professor W. B. Gregory, of Tulane University; J. H. Herron, of Cleveland; and G. A. Orrok, J. W. Roe and H. A. Reed, of New York.

FEDERATED AMERICAN ENGINEERING SOCIETIES

The Federated American Engineering Societies, created in the latter part of 1920, promptly appointed a committee of 18 distinguished engineers to undertake the study of the restrictions and wastes in industry. The essence of the plan was to gather quickly such concrete information as might be used to stimulate action and to lay the foundation for other studies. Within five months the committee completed an analysis of waste in 6 typical branches of industry and on June 3 presented a summary of its findings to the American Engineering Council. The industries studied are of various character and enormous output and were found to have very large wastes, which the committee believes exist in other industries that, when investigated, will prove to be preventible and traceable to the same causes.

The investigation was carried out systematically on rational lines by use of an elaborate questionnaire containing 25 large pages of classified guide questions for the field workers, which assured to a considerable degree its uniformity of method and result. On this basis 50 engineers spent approximately two months each in securing information upon which the reports were based that have been submitted to engineers or others having particular knowledge, for constructive criticism and suggestion.

The investigation clearly indicates that industrial waste is caused, not only by failure to use the time and energy of the men, but also from failure to use productive equipment. Therefore to eliminate waste, more must be accomplished in the same time, or the same accomplished in less time.

There are nearly 300,000 industrial plants in American industry divided by the census into 14 major classes, and a group of representative plans in each of six classes was studied. The branches of industry already investigated are Buildings, Clothing, Shoes, Printing, Metal Trades and Textile Manufacturing. The complete report will comprise Section 1, summary of detailed reports, now just released: Section 2, engineers' field reports; and Section 3, general reports. The investigation has been carried through at cost or less and should be of great intrinsic value for the practical data secured and also potential for the inception and development of future investigations of the highest importance.

PERSONALS

Briggs, B. A., has been appointed on the Colorado State Highway Department.

Middleton, Ellis G., is now connected with the Highway Commission of West Virginia.

Gallagher, R. O., is resident engineer for the Tennessee Highway Department on the construction of a federal aid road between Mountain City and Bristol.

Freeman, Dr. A. W., will become resident lecturer on public health administration, Johns Hopkins School of Hygiene and Public Health, Baltimore.

Galvin, John F., Richmond, Cal., has been made secretary of the California State Highway Commission.

Snyder, D. D., commissioner of Public Works of Rutland, Vt., has joined the Frissell Engineering Co., Gardner, Mass.

Kent, E. S., has opened an architect's office at 72 Webster avenue, Bangor, Me.

Davies, C. E., has been appointed managing editor for the publication of the American Society of Mechanical Engineers.

Hicks, Joshau, has been appointed water, light and sewer commissioner of Wymore, Neb.

Costello, James W., an engineer in the department of streets and public improvements of Newark, N. J., has been appointed general supervisor of the bureau of docks.

Horridge, John, of Philadelphia, Pa., has been appointed supervising engineer in the division of street cleaning, department of public works, Philadelphia.

Morse, Fred S., has been appointed city engineer of Springfield, Ill.

McDougall, Alex, has been appointed to valuate the plant of the Ottawa Electric Co.

Cauchon, Noulan, submitted to the Hamilton Harbor Commission a project for the purpose of effecting an improvement in the proposed harbor scheme.

Gardner, J. C., has been appointed city engineer of Niagara Falls, Ont.

W. C. Morse has opened offices in Seattle, Wash., for the practice of general engineering and contracting work.

E. W. Verity, Jr., has been made construction manager of the Admiral & Co.'s New York office and Carl H. Sanborn of the Boston office.

W. C. Morce has opened a contracting engineering office in Seattle, Wash.

F. A. Forkelson has been placed in charge of the road construction and structural steel work of the Randolph M. Hansen Co., of Green Bay, Wis.

H. E. Heilman has been appointed in charge of the Detroit office of the Joseph L. Skelton Engineering Co., at 1156 Penobscott building.

John A. Conboy Co. has opened offices in Philadelphia, Pa.

McClure-Green Engineering Co., 612 Park building, Worcester, Mass., will specialize in municipal engineering.

Stanislaw Ducharme has been appointed a member of the Board of Water Commissioners of the City of Chicopee, Mass.

J. O. G. Gibbons and C. F. Brown have opened a consulting engineering office in Newark, N. J., and will specialize in power plants and industrial problems.

Chalmers, G. H., has been appointed resident engineer for the construction of extensions to the water works system of St. Thomas, Ont.

Catlett, George F., has been appointed principal assistant engineer of the Bureau of Engineering, North Carolina State, Board of Health.

Givan, Albert, has been appointed city engineer of Sacramento, Cal.

Ballew, Ralph D., has been appointed city manager of Grand Rapids, Mich.

Maxwell, W. D., has been reappointed county engineer of Sac county, Iowa.

Morse, S. T., city engineer of Carlinville, Ill., was killed in an automobile accident on June 3.

Hunt, A. L., county engineer, Baker county, Fla., died July 4 at West Palm Beach.

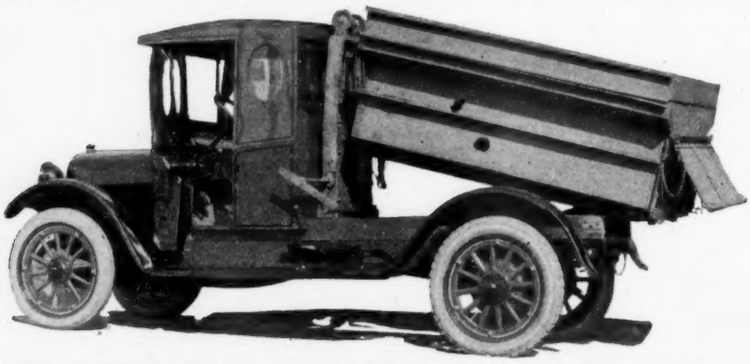
Pope, Geo. W., contracting structural engineer, Minneapolis, Minn., died on July 9.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

YULE DUMP BODIES AND HOISTS

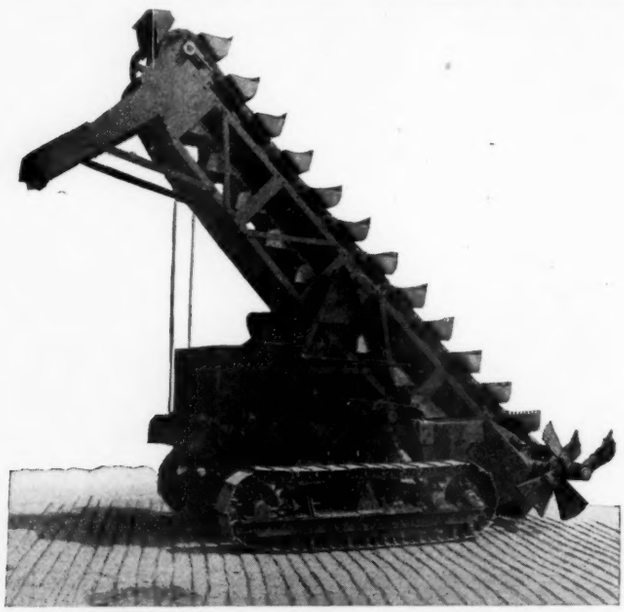
The Yule steel bodies made by the Way Products Co., and especially built for the Reo speed wagon chassis, are designed to provide an indestructible general purpose body of sectional construction with straight sides, double-acting tail gate, equipped with spreading device and extension side boards that may be used as a dumping unit or as an express or stake body.



YULE THREE-SECTION STEEL TRUCK BODY EQUIPPED WITH YULE HOIST

The 3-section body, model 12, designed for coke, ashes, garbage, snow and other light materials has a water measure capacity of 80 cubic feet or for 1 ton of coke. By unbolting and removing its upper section or course, the body becomes model El with a water measure capacity of 60 cubic feet or 1½ tons of bituminous coal, and by unbolting and removing the second section the lower part only remains, forming model 012 with a capacity of 27 cubic feet or 1 yard of gravel or with extension sides 40 cubic feet water measure.

When equipped with the Yule hoist the body, loaded to capacity, may be elevated by hand to an angle of 50 degrees and dumped in less than a minute, the elevation of the body is sufficient for the quick and complete discharge of almost any contents, and it may be held safely in any position by a ratchet. The hoist, which weighs 265 pounds, when mounted occupies less than 12 inches space in the rear of the driver's seat, will fit any chassis and may be installed easily and quickly without drilling a hole. All gears are concealed and there are no parts to break or get out of order.



10,000-POUND GASOLENE WAGON LOADER WITH CREEPER EQUIPMENT AND FEEDING PROPELLERS

HAISS CREEPER EQUIPPED PATH DIGGING WAGON LOADER

These machines are claimed to be the lowest in first cost and the cheapest in operation for handling crushed stone, coke, sand, gravel, and, in fact, any friable material that will pass through a 4-inch ring and that weighs not more than 125 pounds to the cubic foot. They are particularly adapted for digging and loading material from sand and gravel banks and for use on soft ground.

For road construction they can be equipped with hoppers holding 27 cubic feet. These loaders, when equipped with hoppers, are particularly used for loading motor trucks with Lee bodies or Tructractors.

If it is desired to load feeding belts to the concrete mixer, the Haiss creeper-equipped path digging wagon loaders can be furnished with swivel or side discharge spouts, whichever is the most adaptable for the particular conditions encountered.

The engines used are 37 h. p. Waukesha gasoline engines with Dixie magneto, Zenith carburetor and Bennett air cleaner. The creepers are 8 feet long, 10 inches wide, and are made of cast steel links connected with high carbon steel pins. The weight of the loader is 10,000 pounds, which gives a bearing pressure of less than 7 pounds per square inch on the ground.

This loader is equipped with the Haiss patented feeding propellers which are a positive drive and do not depend upon the cohesion of the material to feed itself into the buckets. The loader is also equipped with a patented slow-speed worm gear which crowds the machine into the material 30 inches a minute, simultaneously with the digging motion. This crowding action working with the feeding propellers, forces a constant flow of material in front of the buckets of the loader.

The width of the creepers overall is 6 feet and the cutting width of the feeding propellers is 7 feet, allowing a 6-inch clearance on each side of the loader for digging its way back into the pile.

INDUSTRIAL NOTES

The Link-Belt Company, Chicago, has just acquired all of the capital stock of the H. W. Caldwell & Son Company, which company will continue to operate under separate corporate existence and under its present name, with practically the same plant management. H. W. Caldwell has been elected a director of the Link-Belt Co.

The Conveyors Corporation of America announces the appointment of Robert B. M. Wilson as sales engineer of the Chicago district, with E. M. Wolfe as assistant.

The Dayton-Dowd Co., of Quincy, Ill., has opened a new district office in the Pioneer Building, St. Paul, Minn., for the sale of its pumping machinery, in charge of George M. Kenyon Co.

The Brown Hoisting Machinery Co., of Cleveland, Ohio, has opened an office in New Orleans, La., with Charles H. White as manager.

Leslie H. Allen, formerly with Fred T. Ley & Co., contractors, has been appointed assistant manager of the Cement Products Bureau of the Portland Cement Association.

John A. Conboy Co., a new sales organization handling contractors' railroad, mine and industrial machinery and equipment, have opened offices in Philadelphia, Pa.